



SEQUENCE LISTING

#4

<110> ZHU, JIAN-KANG

LIU, JIPING

ISHITANI, MANABU

HALFTER, URSULA

KIM, CHEOL-SOO

043435-0001
FOR SEQ. SE. 434350
<120> PROTEINS AND DNA RELATED TO SALT TOLERANCE IN PLANTS

<130> 205645US20

<140> 09/824,735

<141> 2001-04-04

<150> US 60/824,735

<151> 2000-04-04

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<170> PatentIn version 3.1

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Met Thr Lys Lys Met Arg Arg Val Gly Lys	
1 5 10	
tac gag gtt ggt cgc aca ata ggt gaa gga acc ttt gct aag gtt aag	2081
Tyr Glu Val Gly Arg Thr Ile Gly Glu Gly Thr Phe Ala Lys Val Lys	
15 20 25	
ttt gcg agg aac aca gac act ggt gat aat gta gcc atc aaa att atg	2129
Phe Ala Arg Asn Thr Asp Thr Gly Asp Asn Val Ala Ile Lys Ile Met	
30 35 40	

gct aag agt aca ata ctt aag aac aga atg gtt gat cag gtaggttctg 2178
 Ala Lys Ser Thr Ile Leu Lys Asn Arg Met Val Asp Gln 55
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taaagctctt ttacag ata aaa aga gag ata tct ata atg aag att gtt cgt 2290
 Ile Lys Arg Glu Ile Ser Ile Met Lys Ile Val Arg 65
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cac ccg aac ata gtg agg ttg tat gag gtaggtttgt ttgtttccat 2337
 His Pro Asn Ile Val Arg Leu Tyr Glu 75
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gcatctgcga aatttttatct ctgaagtgtt ttgcatcat tggtcttctg ttgttttttt 2397

gtaggtttcc cgatgtag gtg ttg gcg agt cct tcg aaa ata tat ata gtt 2448
 Val Leu Ala Ser Pro Ser Lys Ile Tyr Ile Val 85
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 Leu Glu Phe Val Thr Gly Gly Glu Leu Phe Asp Arg Ile 100
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aatcttttca tgcag gtt cat aaa ggg agg ctt gaa gaa agt gag tct cgg 2608
 Val His Lys Gly Arg Leu Glu Glu Ser Glu Ser Arg 110
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aaa tac ttt caa cag ctt gta gat gct gtt gct cat tgt cac tgc aag 2656
 Lys Tyr Phe Gln Gln Leu Val Asp Ala Val Ala His Cys His Cys Lys 125
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 Gly Val Tyr His Arg Asp Leu Lys 135
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ctcagaatat ctactgcgt tgcaatccag acttgatatt tttgtgtcgc tatgttatgt 2770

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 Pro Glu Asn Leu Leu Leu Asp Thr Asn Gly Asn Leu Lys Val 150
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 Ser Asp Phe Gly Leu Ser Ala Leu Pro Gln Glu 160
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 185 190 195

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 Gly Val Ile Leu Phe Val Ile Leu Ala Gly Tyr Leu Pro Phe Ser Glu
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 Thr Asp Leu Pro Gly Leu Tyr Arg Lys
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 Glu Phe Ser Cys Pro Pro Trp Phe Ser Ala Glu Val Lys Phe Leu Ile
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gat agg ata ctt gac ccc aat ccc aaa aca gtgagtattt tgctttgttc 3334
 His Arg Ile Leu Asp Pro Asn Pro Lys Thr
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 Arg Ile Gln Ile Gln Gly Ile Lys Lys Asp
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cct tgg ttc aga tta aat tat gtg cct ata cga gca agg gaa gaa gaa 3495
 Pro Trp Phe Arg Leu Asn Tyr Val Pro Ile Arg Ala Arg Glu Glu Glu
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gaa gtg aat ttg gat gat att cgt gca gtt ttt gat gga att gag 3540
 Glu Val Asn Leu Asp Asp Ile Arg Ala Val Phe Asp Gly Ile Glu
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gct gtt gtg ata gag gtaattattg cttgttggtga ttgtaatatata agtttgcttt 4831
Ala Val Val Ile Glu
390

gcttcagttt aagggtatct agcaaattga aattaaccta catgcag att tac gag 4887
Ile Tyr Glu

gtg gca cca tcg ctt ttc atg gta gac gta aga aag gct gct ggt gaa 4935
Val Ala Pro Ser Leu Phe Met Val Asp Val Arg Lys Ala Ala Gly Glu
395 400 405

act ctt gaa tat cac aag gtttataaat atatatccaa taacaatagt 4983
Thr Leu Glu Tyr His Lys
410 415

tgcatcatta ctgtgttgcg gattagagtg atattttgtt ttgtggtatc gcag ttc 5040
Phe

aac aag aag cta tgt tcg aaa ctg gaa aac ata ata tgg agg gca aca 5088
Tyr Lys Lys Leu Cys Ser Lys Leu Glu Asn Ile Ile Trp Arg Ala Thr
420 425 430

gaa gga ata cca aag tca gag att ctc aga aca atc acg ttt 5130
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<211> 446

<212> PRT

<213> Arabidopsis thaliana

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35

40

45

Lys Asn Arg Met Val Asp Gln Ile Lys Arg Glu Ile Ser Ile Met Lys
50 55 60

Ile Val Arg His Pro Asn Ile Val Arg Leu Tyr Glu Val Leu Ala Ser
65 70 75 80

Pro Ser Lys Ile Tyr Ile Val Leu Glu Phe Val Thr Gly Gly Glu Leu
85 90 95

Phe Asp Arg Ile Val His Lys Gly Arg Leu Glu Glu Ser Glu Ser Arg
100 105 110

Lys Tyr Phe Gln Gln Leu Val Asp Ala Val Ala His Cys His Cys Lys
115 120 125

Gly Val Tyr His Arg Asp Leu Lys Pro Glu Asn Leu Leu Leu Asp Thr
130 135 140

Asn Gly Asn Leu Lys Val Ser Asp Phe Gly Leu Ser Ala Leu Pro Gln
145 150 155 160

Glu Gly Val Glu Leu Leu Arg Thr Thr Cys Gly Thr Pro Asn Tyr Val
165 170 175

Ala Pro Glu Val Leu Ser Gly Gln Gly Tyr Asp Gly Ser Ala Ala Asp
180 185 190

Ile Trp Ser Cys Gly Val Ile Leu Phe Val Ile Leu Ala Gly Tyr Leu
195 200 205

Pro Phe Ser Glu Thr Asp Leu Pro Gly Leu Tyr Arg Lys Ile Asn Ala
210 215 220

Ala Glu Phe Ser Cys Pro Pro Trp Phe Ser Ala Glu Val Lys Phe Leu
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Ile His Arg Ile Leu Asp Pro Asn Pro Lys Thr Arg Ile Gln Ile Gln

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250

255

Gly Ile Lys Lys Asp Pro Trp Phe Arg Leu Asn Tyr Val Pro Ile Arg
260 265 270

Ala Arg Glu Glu Glu Glu Val Asn Leu Asp Asp Ile Arg Ala Val Phe
275 280 285

Asp Gly Ile Glu Gly Ser Tyr Val Ala Glu Asn Val Glu Arg Asn Asp
290 295 300

Glu Gly Pro Leu Met Met Asn Ala Phe Glu Met Ile Thr Leu Ser Gln
305 310 315 320

Gly Leu Asn Leu Ser Ala Leu Phe Asp Arg Arg Gln Asp Phe Val Lys
325 330 335

Arg Gln Thr Arg Phe Val Ser Arg Arg Glu Pro Ser Glu Ile Ile Ala
340 345 350

Asn Ile Glu Ala Val Ala Asn Ser Met Gly Phe Lys Ser His Thr Arg
355 360 365

Asn Phe Lys Thr Arg Leu Glu Gly Leu Ser Ser Ile Lys Ala Gly Gln
370 375 380

Leu Ala Val Val Ile Glu Ile Tyr Glu Val Ala Pro Ser Leu Phe Met
385 390 395 400

Val Asp Val Arg Lys Ala Ala Gly Glu Thr Leu Glu Tyr His Lys Phe
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35 40 45

Gly Ala His Ile Gly Asn Tyr Gln Ile Val Lys Thr Leu Gly Glu Gly
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Ser Phe Gly Lys Val Lys Leu Ala Tyr His Thr Thr Thr Gly Gln Lys
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Val Ala Leu Lys Ile Ile Asn Lys Lys Val Leu Ala Lys Ser Asp Met
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Gln Gly Arg Ile Glu Arg Glu Ile Ser Tyr Leu Arg Leu Leu Arg His
100 105 110

Pro His Ile Ile Lys Leu Tyr Asp Val Ile Lys Ser Lys Asp Glu Ile
115 120 125

Ile Met Val Ile Glu Tyr Ala Gly Asn Glu Leu Phe Asp Tyr Ile Val
130 135 140

Gln Arg Asp Lys Met Ser Glu Gln Glu Ala Arg Arg Phe Phe Gln Gln
145 150 155 160

Ile Ile Ser Ala Val Glu Tyr Cys His Arg His Lys Ile Val His Arg
165 170 175

Asp Leu Lys Pro Glu Asn Leu Leu Leu Asp Glu His Leu Asn Val Lys
180 185 190

Ile Ala Asp Phe Gly Leu Ser Asn Ile Met Thr Asp Gly Asn Phe Leu
195 200 205

Lys Thr Ser Cys Gly Ser Pro Asn Tyr Ala Ala Pro Glu Val Ile Ser
210 215 220

Gly Lys Leu Tyr Ala Gly Pro Glu Val Asp Val Trp Ser Cys Gly Val
225 230 235 240

Ile Leu Tyr Val Met Leu Cys Arg Arg Leu Pro Phe Asp Asp Glu Ser
245 250 255

Ile Pro Val Leu Phe Lys Asn Ile Ser Asn Gly Val Tyr Thr Leu Pro
260 265 270

Ile Phe Leu Ser Pro Gly Ala Ala Gly Leu Ile Lys Arg Met Leu Ile
275 280 285

Val Asn Pro Leu Asn Arg Ile Ser Ile His Glu Ile Met Gln Asp Asp
290 295 300

Trp Phe Lys Val Asp Leu Pro Glu Tyr Leu Leu Pro Pro Asp Leu Lys
305 310 315 320

Pro His Pro Glu Glu Glu Asn Glu Asn Asn Asp Ser Lys Lys Asp Gly
325 330 335

Ser Ser Pro Asp Asn Asp Glu Ile Asp Asp Asn Leu Val Asn Ile Leu
340 345 350

Ser Ser Thr Met Gly Tyr Glu Lys Asp Glu Ile Tyr Glu Ser Leu Glu
355 360 365

Ser Ser Glu Asp Thr Pro Ala Phe Asn Glu Ile Arg Asp Ala Tyr Met
370 375 380

Leu Ile Lys Glu Asn Lys Ser Leu Ile Lys Asp Met Lys Ala Asn Lys
 385 390 395 400

Ser Val Ser Asp Glu Leu Asp Thr Phe Leu Ser Gln Ser Pro Pro Thr
 405 410 415

Phe Gln Gln Gln Ser Lys Ser His Gln Lys Ser Gln Val Asp His Glu
 420 425 430

Thr Ala Lys Gln His Ala Arg Arg Met Ala Ser Ala Ile Thr Gln Gln
 435 440 445

Arg Thr Tyr His Gln Ser Pro Phe Met Asp Gln Tyr Lys Glu Glu Asp
 450 455 460

Ser Thr Val Ser Ile Leu Pro Thr Ser Leu Pro Gln Ile His Arg Ala
 465 470 475 480

Asn Met Leu Ala Gln Gly Ser Pro Ala Ala Ser Lys Ile Ser Pro Leu
 485 490 495

Val Thr Lys Lys Ser Lys Thr Arg Trp His Phe Gly Ile Arg Ser Arg
 500 505 510

Ser Tyr Pro Leu Asp Val Met Gly Glu Ile Tyr Ile Ala Leu Lys Asn
 515 520 525

Leu Gly Ala Glu Trp Ala Lys Pro Ser Glu Glu Asp Leu Trp Thr Ile
 530 535 540

Lys Leu Arg Trp Lys Tyr Asp Ile Gly Asn Lys Thr Asn Thr Asn Glu
 545 550 555 560

Lys Ile Pro Asp Leu Met Lys Met Val Ile Gln Leu Phe Gln Ile Glu
 565 570 575

Thr Asn Asn Tyr Leu Val Asp Phe Lys Phe Asp Gly Trp Glu Ser Ser
 580 585 590

Tyr Gly Asp Asp Thr Thr Val Ser Asn Ile Ser Glu Asp Glu Met Ser
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Glu Leu Ala Val Asn Ser Gln Ser Asn
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<210> 4

<211> 552

<212> PRT

<213> Homo sapiens

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Gly Glu His Gln Leu Thr Gly His Lys Val Ala Val Lys Ile Leu Asn
 35 40 45

Arg Gln Lys Ile Arg Ser Leu Asp Val Val Gly Lys Ile Lys Arg Glu
 50 55 60

Ile Gln Asn Leu Lys Leu Phe Arg His Pro His Ile Ile Lys Leu Tyr
 65 70 75 80

Gln Val Ile Ser Thr Pro Thr Asp Phe Phe Met Val Met Glu Tyr Val
 85 90 95

Ser Gly Gly Glu Leu Phe Asp Tyr Ile Cys Lys His Gly Arg Val Glu
 100 105 110

Glu Met Glu Ala Arg Arg Leu Phe Gln Gln Ile Leu Ser Ala Val Asp
 115 120 125

Tyr Cys His Arg His Met Val Val His Arg Asp Leu Lys Pro Glu Asn
 130 135 140

Val Leu Leu Asp Ala His Met Asn Ala Lys Ile Ala Asp Phe Gly Leu
 145 150 155 160

Ser Asn Met Met Ser Asp Gly Glu Phe Leu Arg Thr Ser Cys Gly Ser
 165 170 175

Pro Asn Tyr Ala Ala Pro Glu Val Ile Ser Gly Arg Leu Tyr Ala Gly
 180 185 190

Pro Glu Val Asp Ile Trp Ser Cys Gly Val Ile Leu Tyr Ala Leu Leu
 195 200 205

Cys Gly Thr Leu Pro Phe Asp Asp Glu His Val Pro Thr Leu Phe Lys
 210 215 220

Lys Ile Arg Gly Gly Val Phe Tyr Ile Pro Glu Tyr Leu Asn Arg Ser
 225 230 235 240

Val Ala Thr Leu Leu Met His Met Leu Gln Val Asp Pro Leu Lys Arg
 245 250 255

Ala Thr Ile Lys Asp Ile Arg Glu His Glu Trp Phe Lys Gln Gly Leu
 260 265 270

Pro Ser Tyr Leu Phe Pro Glu Asp Pro Ser Tyr Asp Ala Asn Val Ile
 275 280 285

Asp Asp Glu Ala Val Lys Glu Val Cys Glu Lys Phe Glu Cys Thr Glu
 290 295 300

Ser Glu Val Met Asn Ser Leu Tyr Ser Gly Asp Pro Gln Asp Gln Leu
 305 310 315 320

Ala Val Ala Tyr His Leu Ile Ile Asp Asn Arg Arg Ile Met Asn Gln
 325 330 335

Ala Ser Glu Phe Tyr Leu Ala Ser Ser Pro Pro Ser Gly Ser Phe Met
 340 345 350

Asp Asp Ser Ala Met His Ile Pro Pro Gly Leu Lys Pro His Pro Glu
 355 360 365

Arg Met Pro Pro Leu Ile Ala Asp Ser Pro Lys Ala Arg Cys Pro Leu
 370 375 380

Asp Ala Leu Asn Thr Thr Lys Pro Lys Ser Leu Ala Val Lys Lys Ala
 385 390 395 400

Lys Trp His Leu Gly Ile Arg Ser Gln Ser Lys Pro Tyr Asp Ile Met
 405 410 415

Ala Glu Val Tyr Arg Ala Met Lys Gln Leu Asp Phe Glu Trp Lys Val
 420 425 430

Val Asn Ala Tyr His Leu Arg Val Arg Arg Lys Asn Pro Val Thr Gly
 435 440 445

Asn Tyr Val Lys Met Ser Leu Gln Leu Tyr Leu Val Asp Asn Arg Ser
 450 455 460

Tyr Leu Leu Asp Phe Lys Ser Ile Asp Asp Glu Val Val Glu Gln Arg
 465 470 475 480

Ser Gly Ser Ser Thr Pro Gln Arg Ser Cys Ser Ala Ala Gly Leu His
 485 490 495

Arg Pro Arg Ser Ser Phe Asp Ser Thr Thr Ala Glu Ser His Ser Leu
 500 505 510

Ser Gly Ser Leu Thr Gly Ser Leu Thr Gly Ser Thr Leu Ser Ser Val
 515 520 525

Ser Pro Arg Leu Gly Ser His Thr Met Asp Phe Phe Glu Met Cys Ala
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Ser Leu Ile Thr Thr Leu Ala Arg
 545 550

<210> 5

<211> 496

<212> PRT

<213> Schizosaccharomyces pombe

<214> 5

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 20 25 30

Lys Ile Tyr Ala Val Lys Phe Val Asn Lys Lys His Ala Thr Ser Cys
 35 40 45

Met Asn Ala Gly Val Trp Ala Arg Arg Met Ala Ser Glu Ile Gln Leu
 50 55 60

His Lys Leu Cys Asn Gly His Lys Asn Ile Ile His Phe Tyr Asn Thr
 65 70 75 80

Ala Glu Asn Pro Gln Trp Arg Trp Val Val Leu Glu Phe Ala Gln Gly
 85 90 95

Gly Asp Leu Phe Asp Lys Ile Glu Pro Asp Val Gly Ile Asp Glu Asp
 100 105 110

Val Ala Gln Phe Tyr Phe Ala Gln Leu Met Glu Gly Ile Ser Phe Met
 115 120 125

His Ser Lys Gly Val Ala His Arg Asp Leu Lys Pro Glu Asn Ile Leu
130 135 140

Leu Asp Tyr Asn Gly Asn Leu Lys Ile Ser Asp Phe Gly Phe Ala Ser
145 150 155 160

Leu Phe Ser Tyr Lys Gly Lys Ser Arg Leu Leu Asn Ser Pro Val Gly
165 170 175

Ser Pro Pro Tyr Ala Ala Pro Glu Ile Thr Gln Gln Tyr Asp Gly Ser
180 185 190

Lys Val Asp Val Trp Ser Cys Gly Ile Ile Leu Phe Ala Leu Leu Leu
195 200 205

Gly Asn Thr Pro Trp Asp Glu Ala Ile Ser Asn Thr Gly Asp Tyr Leu
210 215 220

Leu Tyr Lys Lys Gln Cys Glu Arg Pro Ser Tyr His Pro Trp Asn Leu
225 230 235 240

Leu Ser Pro Gly Ala Tyr Ser Ile Ile Thr Gly Met Leu Arg Ser Asp
245 250 255

Pro Phe Lys Arg Tyr Ser Val Lys His Val Val Gln His Pro Trp Leu
260 265 270

Thr Ser Ser Thr Pro Phe Arg Thr Lys Asn Gly Asn Cys Ala Asp Pro
275 280 285

Val Ala Leu Ala Ser Arg Leu Met Leu Lys Leu Arg Ile Asp Leu Asp
290 295 300

Lys Pro Arg Leu Ala Ser Ser Arg Ala Ser Gln Asn Asp Ser Gly Phe
305 310 315 320

Ser Met Thr Gln Pro Ala Phe Lys Lys Asn Asp Gln Lys Glu Leu Asp
325 330 335

Arg Val Glu Val Tyr Gly Ala Leu Ser Gln Pro Val Gln Leu Asn Lys
 340 345 350

Asn Ile Asp Val Thr Glu Ile Leu Glu Lys Asp Pro Ser Leu Ser Gln
 355 360 365

Phe Cys Glu Asn Glu Gly Phe Ile Lys Arg Leu Ala Lys Lys Ala Lys
 370 375 380

Asn Phe Tyr Glu Ile Cys Pro Pro Glu Arg Leu Thr Arg Phe Tyr Ser
 385 390 395 400

Arg Ala Ser Arg Glu Thr Ile Ile Asp His Leu Tyr Asp Ser Leu Arg
 405 410 415

Leu Leu Ala Ile Ser Val Thr Met Lys Tyr Val Arg Asn Gln Thr Ile
 420 425 430

Leu Tyr Val Asn Leu His Asp Lys Arg Lys Cys Leu Leu Gln Gly Val
 435 440 445

Ile Glu Leu Thr Asn Leu Gly His Asn Leu Glu Leu Ile Asn Phe Ile
 450 455 460

Lys Arg Asn Gly Asp Pro Leu Glu Trp Arg Lys Phe Phe Lys Asn Val
 465 470 475 480

Val Ser Ser Ile Gly Lys Pro Ile Val Leu Thr Asp Val Ser Gln Asn
 485 490 495

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<212> PRT

<213> Homo sapiens

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Glu Ala Val Ala Val Lys Ile Val Asp Met Lys Arg Ala Val Asp Cys
35 40 45

Pro Glu Asn Ile Lys Lys Glu Ile Cys Ile Asn Lys Met Leu Asn His
50 55 60

Glu Asn Val Val Lys Phe Tyr Gly His Arg Arg Glu Gly Asn Ile Gln
70 75 80

Tyr Leu Phe Leu Glu Tyr Cys Ser Gly Gly Glu Leu Phe Asp Arg Ile
85 90 95

Glu Pro Asp Ile Gly Met Pro Glu Pro Asp Ala Gln Arg Phe Phe His
100 105 110

Gln Leu Met Ala Gly Val Val Tyr Leu His Gly Ile Gly Ile Thr His
115 120 125

Arg Asp Ile Lys Pro Glu Asn Leu Leu Leu Asp Glu Arg Asp Asn Leu
130 135 140

Lys Ile Ser Asp Phe Gly Leu Ala Thr Val Phe Arg Tyr Asn Asn Arg
145 150 155 160

Glu Arg Leu Leu Asn Lys Met Cys Gly Thr Leu Pro Tyr Val Ala Pro
165 170 175

Glu Leu Leu Lys Arg Arg Glu Phe His Ala Glu Pro Val Asp Val Trp
180 185 190

Ser Cys Gly Ile Val Leu Thr Ala Met Leu Ala Gly Glu Leu Pro Trp
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Asp Gln Pro Ser Asp Ser Cys Gln Glu Tyr Ser Asp Trp Lys Glu Lys
210 215 220

Lys Thr Tyr Leu Asn Pro Trp Lys Lys Ile Asp Ser Ala Pro Leu Ala
225 230 235 240

Leu Leu His Lys Ile Leu Val Glu Asn Pro Ser Ala Arg Ile Thr Ile
245 250 255

Pro Asp Ile Lys Lys Asp Arg Trp Tyr Asn Lys Pro Leu Lys Lys Gly
260 265 270

Ala Lys Arg Pro Arg Val Thr Ser Gly Gly Val Ser Glu Ser Pro Ser
275 280 285

Gly Phe Ser Lys His Ile Gln Ser Asn Leu Asp Phe Ser Pro Val Asn
290 295 300

Ser Ala Ser Ser Glu Glu Asn Val Lys Tyr Ser Ser Ser Gln Pro Glu
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Pro Arg Thr Gly Leu Ser Leu Trp Asp Thr Ser Pro Ser Tyr Ile Asp
325 330 335

Lys Leu Val Gln Gly Ile Ser Phe Ser Gln Pro Thr Cys Pro Asp His
340 345 350

Met Leu Leu Asn Ser Gln Leu Leu Gly Thr Pro Gly Ser Ser Gln Asn
355 360 365

Pro Trp Gln Arg Leu Val Lys Arg Met Thr Arg Phe Phe Thr Lys Leu
370 375 380

Asp Ala Asp Lys Ser Tyr Gln Cys Leu Lys Glu Thr Cys Glu Lys Leu
385 390 395 400

Gly Tyr Gln Trp Lys Lys Ser Cys Met Asn Gln Val Thr Ile Ser Thr
405 410 415

Thr Asp Arg Arg Asn Asn Lys Leu Ile Phe Lys Val Asn Leu Leu Glu
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Met Asp Asp Lys Ile Leu Val Asp Phe Arg Leu Ser Lys Gly Asp Gly
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Leu Glu Phe Lys Arg His Phe Leu Lys Ile Lys Gly Lys Leu Ile Asp
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